

**Fish Exclusion Protocols  
and Standards**

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## **WSDOT Fish Exclusion Protocols and Standards**

Prior to dewatering, all fish and other vertebrate aquatic life will be removed from sites that will be dewatered. For projects where in-water work is limited to a specific area and dewatering will not occur, fish will be excluded from the area to the maximum extent feasible within an isolated work area.

The sequence for fish exclusion is as follows:

- Isolation of the work area.
- Removal of as many fish as possible.
- Gradual dewatering of the work area (if the work area is to be dewatered).
- Removal of remaining fish.
- Record fish exclusion activities and notify Services as required.

Isolation of the work area, fish removal and release shall be conducted or directed by a biologist who possesses the competence to ensure the safe handling of all Endangered Species Act (ESA) listed fish, and who is also experienced with work area isolation. This protocol may not apply or may be modified in emergency situations or in certain areas that have unique site-specific characteristics.

### **Isolation of the Work Area**

Installation of block nets will occur at predetermined locations, based on site characteristics, to prevent fish and other aquatic wildlife from moving into the work area. Sites will be selected based on desirable attributes such as slower flows and suitable locations for stake and/or gravel bag placement. Areas with heavy vegetation, undercut banks, deep pools, etc. will be avoided due to the difficulty of sealing nets. The downstream block net will be angled across the stream if possible to prevent impingement of fish on the net. Additionally, a “mini-pool” may be constructed at the downstream block net to provide a lower velocity area for fish to maneuver away from the net. Whenever conditions allow, the upstream block net shall be placed first. The downstream block net shall then be used as a seine to herd fish from the upstream block net location downstream to the point selected for the downstream block net installation. If feasible, this action will potentially move significant numbers of fish downstream, out of the impact area prior to other removal methods.

Block net mesh size, length, type of material, and depth will vary based on site conditions. The directing biologist on site will base the design of block nets on specific site characteristics such as water depth, velocity and channel width. Typical block net material is 9.5 millimeter stretched mesh. Block nets shall remain in place until in-water work is completed. Block nets will require frequent leaf and debris removal. An individual will be assigned the responsibility of frequently checking the nets to maintain their effectiveness and integrity. The frequency of such checks will be determined on a

case-by-case basis, dependent upon the system, season and weather conditions. Block nets need to be secured along both banks and in-channel to prevent failure during unforeseen rain events or debris accumulation. Some locations may require additional block net support (examples include galvanized hardware cloth and metal fence posts).

## **Fish Removal and Dewatering**

If the site is dewatered, dewatering and the placement of cofferdams or diversions will be in accordance with any provisions contained in the Hydraulic Project Approval (HPA) permit from WDFW.

Pumps used to temporarily bypass water around a work site, or to dewater residual pools within a dewatered site, shall be fitted with mesh screens to prevent aquatic life from entering the intake hose of the pump. The screens will also prevent aquatic life from entering the intake hose if a block net should fail. Screens shall be placed approximately 2-4 feet from the end of the intake hose to assure fish are not pinned upon the screen. Screening techniques must utilize the specifications in the HPA and be in compliance with Washington State Laws RCW 77.55.320, RCW 77.55.040 and RCW 77.55.070.

The site will be dewatered slowly enough to allow the efficient removal of all fish species and avoid strandings. The site will be rewatered slowly enough to prevent the loss of surface water downstream as the streambed absorbs water and to minimize or avoid a sudden increase in stream turbidity. During rewatering, the site will be monitored to prevent stranding of aquatic organisms below the construction site.

### Removal Methods:

Methods for exclusion or removal of fish from the area between the block nets are described below. These methods are given in order of preference and for many locations a combination of methods will need to be applied. The use of visual observation techniques (e.g., snorkeling, surveying with polarized glasses or Plexiglas bottomed buckets) should be considered for evaluation of removal method effectiveness and to identify specific locations of fish concentrations prior to removal attempts.

- **Seining** shall be the preferred method. The remaining methods shall be used when seining is not possible or to enhance the effectiveness of removal through seining. Seines made from 9.5 mm stretched nylon mesh shall be used to remove fish from the isolated stream reach. Seine design will be dependent upon site-specific characteristics. The on-site biologist will plan seining procedures based on an evaluation of site characteristics. Seines, once pursed, will remain partially in the water while aquatic life is removed. Aquatic life will be captured by personnel in water or on shore using hand held nets.
- **Baited minnow traps** (typically used in conjunction with seining) may be left in overnight, but will be checked at least three times daily to minimize predation within the trap. Traps will be checked more frequently if temperatures are in excess of 15°C.

- **Dip Nets and Hand Removal** will be used in conjunction with seining and as a site is slowly dewatered. This usually occurs after other methods.
- **Connecting rod snakes** will be used to help move fish out of stream crossing structures. The connecting rod snake is made of wood sections approximately three feet in length. When dewatering is to occur a seine may be placed at the downstream end of the crossing structure. As the water level goes down fish inside the culvert, in theory, will evacuate downstream into the seine that is in place at the outlet. The snake may be wiggled slowly through the pipe to encourage evacuation of fish out of the culvert. Other previously listed capture techniques shall be employed if required.
- **Electrofishing** shall be performed only when other methods have been determined to be unfeasible or ineffective by the directing biologist. Electrofishing studies document injury rates to fish even at low settings. Therefore, use of this method is discouraged when unnecessary. For sites that will not be dewatered, the potential for injury to ESA-listed fish may outweigh the benefit of capture and relocation of all fish present in the work area. Electrofishing research results reveal a trend that as number of vertebrae and spine length increase, injury potential also increases. Therefore, the capture and removal of adult ESA-listed fish by electrofishing will be avoided when possible<sup>1</sup>.

The following conditions shall apply to use of electrofishing as a means of fish removal:

1. The USFWS will be provided written notification 10 working days prior to the initiation of electrofishing.
2. Electrofishing shall only be conducted when a biologist with at least 100 hours of electrofishing experience is on site to conduct or direct all activities associated with capture attempts. The directing biologist shall be familiar with the principles of electrofishing including the interrelated effects of voltage, pulse width and pulse rate on fish species and associated risk of injury/mortality. The directing biologist shall have knowledge regarding galvanotaxis, narcosis and tetany, their respective relationships to injury/mortality rates, and have the ability to recognize these responses when exhibited by fish.
3. The following chart shall be used as guidelines for electrofishing in water where the potential to encounter ESA-listed juvenile fish exists. Only DC or pulsed DC current will be used. Visual observation of the size classes of fish in the work area is helpful to avoid injury to larger fish by the mistaken assumption that they are not present.

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<sup>1</sup> Timing windows provided by WDFW will be used to minimize the chance of encountering adult proposed or listed fish. However, complete avoidance may not be possible with resident bull trout.

**Guidelines for initial and maximum settings for backpack electrofishing<sup>2</sup>.**

	<b>Initial Setting</b>	<b>Conductivity (<math>\mu\text{S}/\text{cm}</math>)</b>	<b>Maximum Settings</b>
Voltage	100 V	$\leq 300$	800 V
		$> 300$	400 V
Pulse Width	500 $\mu\text{s}$		5 ms
Pulse Rate	15 Hz		60 Hz (In general, exceeding 40 Hz will injure more fish)

Each session shall begin with low settings for pulse width and pulse rate. If fish present in the area being electrofished do not exhibit an appropriate response, the settings shall be gradually increased until the appropriate response is achieved (galvanotaxis). Conducting electrofishing activity at the minimal effective settings is imperative because as pulse width and pulse rate increase, fish injury rates increase. Minimum effective voltage settings are dependent upon water conductivity and will need to increase as conductivity decreases. Higher voltages elevate the risk of serious injury to fish removal personnel. The lowest effective setting for pulse width, pulse rate and voltage will be used to minimize personnel safety concerns and help minimize fish injury/mortality rates.

4. Seasonal timing restrictions for conducting electrofishing shall be dependent upon the river system, fish composition and an analysis of the life history of documented species. Spawning adults and redds with incubating eggs will not be subjected to the effects of electrofishing. As a general rule, waters with anadromous salmon should not be electrofished from October 15 to May 15 and resident waters from November 1 to May 15. In waters with potential bull trout presence, the timing may be more restrictive. It shall be the responsibility of the directing biologist to research and assess the time of year (for each river segment) when electrofishing is appropriate.
5. An individual shall be stationed at the downstream block net continuously during electrofishing sessions to recover stunned fish in the event they are washed downstream and pinned against the net.
6. The operator shall avoid allowing fish to come into contact with the anode. The zone of potential fish injury is 0.5 m from the anode. Netting shall never be attached to the anode. Techniques employed when using an unnetted anode keep fish farther from the anode and expose them to significantly less time in the zone of potential injury. Extra care shall be taken near in-water structures or undercut banks, in shallow waters or high-density fish areas. In these areas fish are more likely to come into close contact with the anode because fish may be less visible and the voltage gradients may be abnormally intensified. Voltage settings in shallow water sections shall be checked and readjusted by the operator if necessary. When electrofishing areas near

undercut banks or where structures may provide cover for fish, the anode will be used to draw the fish out by placing the activated anode near the area fish are likely present and slowly drawing the anode away. Fish experiencing galvanotaxis will be attracted to the anode and will swim away from the structure toward the anode so that they can be netted. This will not work on fish that experience narcosis or tetany. Therefore, fish response will be noted in adjacent areas prior to attempts made near structures. This should help avoid prolonged exposure of fish to the electrical field while in an immobilized state.

7. Electrofishing shall be performed in a manner that minimizes harm to fish. Once an appropriate fish response (galvanotaxis) is noted, the stream segment shall be worked systematically, moving the anode continuously in a herringbone pattern through the water without electrofishing one area for an extended period of time. The number of passes shall be kept to a minimum, will be dependent upon site-specific characteristics, and be at the discretion of the directing biologist. Adequate numbers of personnel shall be on-site to minimize the number of passes required for fish removal. Adequate staff to net, recover, and release fish as soon as possible shall be present. Fish shall be removed from the electrical field immediately. Fish shall not be held in the net while continuing to capture additional fish.
8. Condition of captured fish will be carefully observed and documented. Dark bands on the body and extended recovery times are signs of injury or handling stress. When such signs are noted, the settings for the electrofishing unit and/or manner in which the electrofishing session is proceeding need adjustment. These characteristics may be an indication that electrofishing has become an inappropriate removal method for that specific site. Each fish shall be capable of remaining upright and actively swimming prior to release (see Fish Handling, Holding and Release section).
9. Electrofishing shall not occur when turbidity reduces visibility to less than 0.5 meters, when water conductivity exceeds 350  $\mu\text{S}/\text{cm}$ , or when water temperature is above 18°C or below 4°C.

#### Fish Handling, Holding and Release:

- Fish handling will be kept to the minimum necessary to remove fish from the work site.
- Fish will not be sampled or anesthetized during removal activities as this protocol is intended to address fish removal not research. Fish species, number, age class estimate, and release location will be documented.
- Individuals handling fish shall ensure that their hands are free of sunscreen, lotion, or insect repellent.
- Fish or other aquatic life captured shall be immediately put into dark colored containers filled with clean stream water. Fish removal personnel shall provide a

healthy environment for fish with minimum holding periods and low fish densities in holding containers to avoid effects of overcrowding. Large fish shall be kept separate from smaller fish to avoid predation during containment. Water-to-water transfers shall occur whenever possible. ESA listed fish should not be transferred out of water to prevent added stress. Holding container temperature and well being of specimens will be frequently monitored to assure that all specimens will be released unharmed. Potential shade areas and supplemental oxygen for fish holding shall be considered in designing fish handling operations.

- The release site(s) will be determined by the directing biologist and may be based on specific site characteristics (flow refuge and cover) and type of fish captured (out migrating smolt, kelt, prespawn migrating adult, etc). More than one site may be designated to provide for varying migrational needs and to separate prey size fish from larger fish. The directing biologist shall consider fish migration requirements, size classes of fish, and duration of work area isolation when designing fish release plans. Each fish shall be capable of remaining upright and have the ability to actively swim upon release. ESA-listed or proposed fish will have priority over other species for release. One person shall be designated to transport specimens in a timely manner to the site selected for release.
- All ESA-listed dead fish shall be preserved and delivered to the pertinent regulatory agency (see documentation below) as outlined in the appropriate permit's conditions.
- If authorized level of take is exceeded, the pertinent regulatory agency shall be notified as soon as possible.

## **Documentation**

- All work area isolation, fish removal and fish release activity shall be thoroughly documented in a log book with the following information: project location, date, methods, personnel, in-stream temperature, visibility, electrofisher settings, and other comments.
- Species, number of each species, age class estimate, and location of release will be recorded for all fish handled.
- Information regarding injuries or mortalities to ESA-listed or proposed species shall be documented and provided within three working days to NOAA fisheries or USFWS, depending on which agency has jurisdiction over that species.